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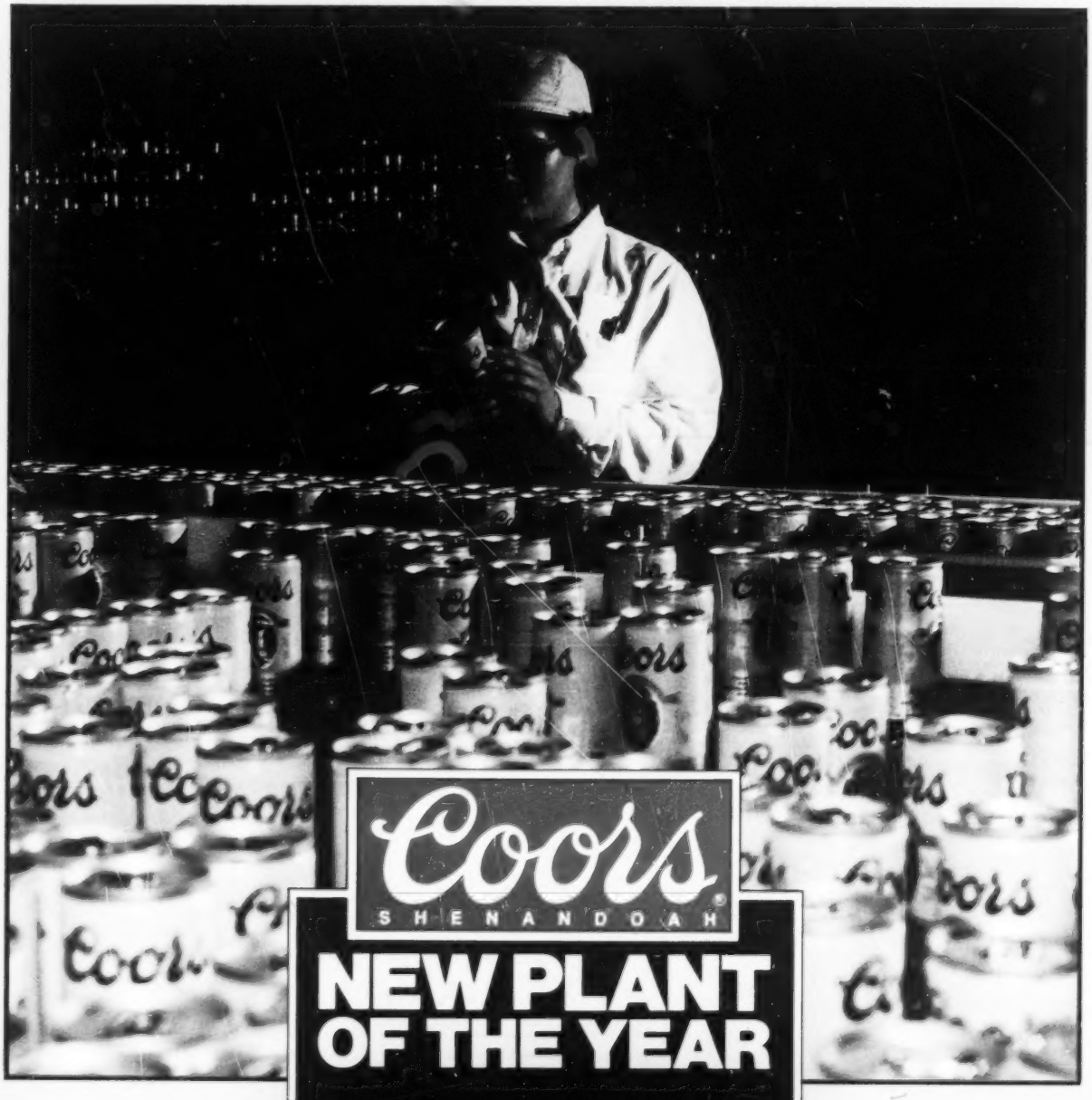

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FOOD ENGINEERING

COVER STORY

Food Engineering's pick for our annual New Plant of the year is Coors Shenandoah Brewery, Elkton, VA. With the opening of this plant, Coors is one step closer to becoming a national brewer. Cover photograph by Tommy Thompson, Harrisonburg, VA.

Pages 65 to 79

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FOOD ENGINEERING® (ISSN 0193-323X) March 1988, Vol. 60, No. 3. Published monthly by Chilton Company, Chilton Way, Radnor, Pa. 19089 (Telephone 215/964-4000). Chilton Co., part of Capital Cities/ABC Inc., New York, N.Y. Second Class Postage Paid at Wayne, Pa. 19087 and additional mailing offices. Title registered in U.S. Patent Office ™Chilton Company, 1987. All rights reserved.

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This month's Report talks about preventing product contamination through microbiological control; FDA's clarification of carcinogenicity in animals; and the Food Safety and Inspection Service revision of its policy spelling out Nutrition Labeling Verification (NLV) procedures for meat and poultry products.

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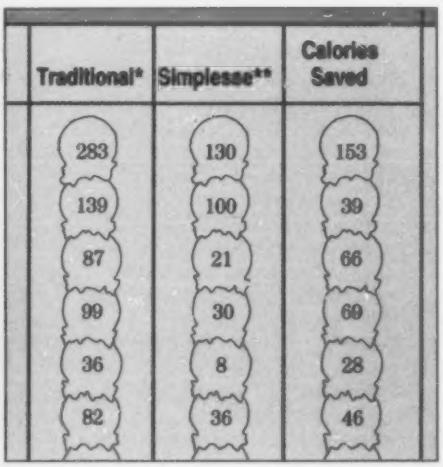

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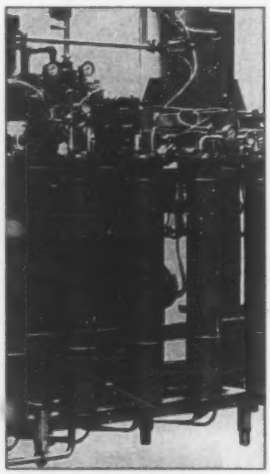

Special Emphasis

ASEPTIC PROCESSING

Although the aseptic packaging technique has found a niche in the beverage market, the broad success predicted for aseptics in the processed foods area has thus far proved elusive.

Pages 93 to 99

Japanese place priority on new products

The Japanese apparently place as much importance on new product development as we do. However, they also place a great deal of importance on new technology. The dynamics and importance of new product and technology developments in the Japanese processed foods and food packaging industry is highlighted by the results of a recent survey conducted for Yanese and Associates.

2,800 new products

According to Yanese and Associates, Japan's dramatic economic success and growth is largely attributable to two primary factors – intense domestic competition for market share and the development of high value-added products. As a result, while the U.S. has twice the population of Japan, Japanese new product introductions are nearly four times as great on a per capita basis. Nearly 2,800 new food products were launched in the Japa-

JAPANESE FOOD MANUFACTURING PRIORITIES

New Product Development	83.3%
Technology Development	66.6%
Profit Increases	63.8%
Development of Individual Talent	63.8%
Information Network	62.2%
Internationalization	58.3%
Increase Market Share	52.7%
Countermeasures for Distribution	50.0%
Entry into the New Business	47.2%
Countermeasures against Sales Tax	47.2%
Sales Increase	44.4%
Cost Reduction	44.4%
Facility Investment	33.3%
Promotion of Consumption	33.3%
Biotechnology R&D	30.5%
Mergers & Acquisitions	25.0%
Countermeasures Against Strong Yen	19.4%
Enhanced Corporate Identity	16.6%
Measures for Market Conditions	13.8%
Measures for Employment	10.8%

Source: Nippon Shokuryo Shimbun

Seventy-two managers of major Japanese food companies considered new product and technology development as the major focus of their strategy.

nese retail market in 1985.

The survey polled seventy-two managers of major Japanese food companies. They indicated that new product and technology development are foremost in their business plans. The Japanese managers stated that the introduction of new products is necessary to satisfy changing consumer requirements. Technological innovation efforts will be focused on processing techniques, ingredients, inspection methods and packaging.

FSIS revises policy on nutrition labeling

In response to suggestions submitted by the National Food Processors Association last fall, the Food Safety and Inspection Service has revised its policy spelling out Nutrition Labeling Verification (NLV) procedures for meat and poultry products.

The revised policy, issued January 26 includes:

- Deletion of requirements to list in-process controls;
- Provision of a one-year period to companies to build a nutrient database during which action would be taken by FSIS only in case of gross violations;
- Granting by FSIS of some exceptions to the 80 percent/120 percent allowance for variations in label declarations in subsequent years;
- Designation of the assistant deputy administrator of regional operations as coordinator of NLV program approvals for firms with plants in several USDA regions.

The original policy memo was released by FSIS in November, 1986, and served as an advisory to industry on the procedures followed by USDA in ensuring the accuracy of nutrition information voluntarily provided by meat and poultry processors on their products. Members of NFPS's Meat and Poultry Products Technical Committee found provisions of the policy unnecessarily burdensome, and informed FSIS that these provisions would discourage processors from voluntarily providing nutritional information on their products.

Copies of the revised policy memo can be obtained from NFPA's Lloyd Hontz, (202) 639-5924.

Yield/quality grading to be separated?

In response to a petition filed by AMI and National Cattlemen's Association, USDA has published a proposal to separate yield and quality grading. "This gives packers who choose to do so, the flexibility to remove excess carcass fat on the slaughter floor," said AMI President Manly Molpus.

Current rules deny packers this option, because USDA requires that, if carcasses are graded, both the yield and the quality grade must be determined. This prohibits hot-fat trimming because graders are unable to determine the yield grade if the fat has been removed prior to grading.

The new proposal would not affect existing grade standards.

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Circle 23 on Inquiry Card

U.S. forges ahead in Agricultural Biotechnology

What directions are our technical achievements in this area taking us? Will we be competitive in a world market?

The U.S. always has been a world leader in developing new technologies – including ones relating to the food processing industry. But concerns about our ability to be first with many of these technologies in a world market have been surfacing.

These concerns – especially as they apply to capitalizing on federal R&D – were addressed by Clarence J. Brown, Deputy Secretary of Commerce, U.S. Department of Commerce at AgBIOTECH '88, a conference on agricultural biotechnology held last January in Washington D.C.

"The U.S. Government spends approximately $60 billion annually on R&D. Not enough of this R&D finds its way into the commercial marketplace," stated Brown. Most companies, whether they realize it or not, are in foreign competition, since 97 percent of the items manufactured in this country – even if they are sold in this country – have foreign competition, he pointed out.

"America's ability to exploit new technologies with huge market potential in the year 2000 and beyond will determine our ability to compete," said Brown. The Department of Commerce recently concluded a major study identifying the primary emerging technologies that will drive the world economy well into the twenty-first century. Within that group, biotechnology – both genetic engineering and biochemical processing – are tagged as having significant potential economic impact.

ANN E. PRZYBYLA
Technical Editor

Commerce Department Policy Recommendations

1. Reduce Federal budget deficit.
2. Create venture capital pools at state and local levels.
3. Create additional tax incentives and other actions to increase savings.
4. Tax law changes should give incentive to modernize.
5. Insist on protection of intellectual property.
6. Train managers in production process; update business schools' curricula.
7. Eliminate discriminary foreign tax provisions.
8. Improve export controls.
9. Reform product liability and tort laws.
10. Clarify and ease antitrust restrictions.

Clarence J. Brown, Deputy Secretary of Commerce, U.S. Department of Commerce listed the Department's recommendations to remove the barriers which stand in the way of the U.S. obtaining maximum benefit from emerging technologies.

Brown listed a number of generic barriers to achieving maximum economic benefit from these emerging technologies:

- High cost of capital in the U.S.,
- U.S. versus foreign tax incentives,
- Management focusing on short-term return on investment,
- Poor integration of manufacturing, design, and R&D functions,
- Inadequate intellectual property protection,
- Compliance and dependence on domestic market,
- Restrictive trade policies in foreign markets,
- Health and safety regulations,
- Export controls on advanced technologies and products,
- Product liability and tort law restraints, and
- Antitrust restrictions.

The Department of Commerce has pushed for a decentralized management of technology to permit the individuals who develop this technology to own and benefit from their discoveries. During the '80s, new laws are allowing universities, small businesses, and all other contractors financed by federal funds the first right of ownership and profit from their patentable inventions developed with federal dollars. And the Technology Transfer Act of 1986 allows similar rights for technology originating in federally funded laboratories.

The Department of Commerce study includes a number of recommendations to remove the barriers identified. These in listed in the accompanying chart.

"No valid reason exists for America losing its technological leadership in the world," stressed Brown. "All the elements of technical supremacy are available if we will use them."

Circle 46 or see FEM, p. 236 →

Dr. Anthony Walker of Arthur D. Little's United Kingdom office compared research priorities within U.S. and European companies involved in plant biotechnology. In Europe there are fewer specialist biotechnology companies than in the U.S. Much of plant biotechnology research in Europe is carried out in larger corporations such as Unilever which recently purchased the Plant Breeding Institute, Bayer, and Hoechst. This denies the U.S. access to European expertise, Walker pointed out.

"The U.S. looks at agricultural biotechnology more from a pure investment point of view of a defensive position, while the Europeans look at this technology more as a marketing outlet in addition to a defensive role."

Walker went on to say that companies in the U.S. look at agricultural biotechnology more from a pure investment point of view or a defensive position, while the Europeans look at this technology more as a marketing outlet in addition to a defensive role.

Establish business first

Companies interested in agricultural biotechnology are being encouraged to establish a business position prior to developing the technology.

"As opposed to investing strictly in technology, we have stressed the need for development of strong production and marketing businesses that would be able to capitalize on the most advanced technologies as they are developed," said John R. Hesse, Managing General Partner, Plant Resources Venture Funds, Cambridge, MA. He explained that this was partly because of the potentially lengthy product development cycle for new products based on genetic improvements of plants and animals – whether by traditional breeding technology or by genetic engineering.

Product positioning

One company, while not involved in the more sophisticated aspects of biotechnology, realizes the importance of properly positioning its products. Columbia, MD-based Igene Biotechnology Inc. recently turned down a proposal to provide Macromin (a low cost nonfat dry milk produced from whey) to a major bakery company, because it did not want to become a high-volume, low-cost commodity producer. Instead the company will look at specialty niche markets such as angel food cake mix.

Agricultural biotechnology historically has had problems attracting investment dollars – especially compared to human health care biotechnology research. The gap does not appropriately reflect the relative size of the markets of the high value sectors within agribusiness, stated Hesse. He attributed this lack of funding to several factors, including insufficient public and investor awareness of the high value sectors of the agricultural input and processing industries, higher visibility to investors of products with potential impact on major human diseases, and technical hurdles specific to the agricultural biotechnology field.

Biochemical pathways

While many of the genetically engineered pharmaceutical products only involve individual proteins encoded by single genes, certain of the more attractive agricultural opportunities involve the manipulation of entire biochemical pathways, the effects of multiple genes, or the interaction between hosts and pathogens, points out Hesse. A major hurdle was overcome, though, with the successful regeneration of whole plants from single cells that were transformed with exogenous DNA.

Some chemicals involved in food processing are relatively simple and can be genetically engineered in microorganisms. For example, DNA Plant Technology Corp., Cinnaminson, NJ, is using somoclonal variation (growing new plants from a few plant cells) to select naturally occurring strains of popcorn which have a butter-like flavor.

"Recent breakthroughs in the transformation of cereal species, and development of novel transformation technologies, encourage our expectations that genetically engineered field crops will reach the marketplace in the 1990's," predicted Hesse. He concluded by stating that total sales of agricultural biotechnology products will go from $25 million in 1988 to $700 million in 1993.

Due to a number of initial public offerings for agricultural biotechnology companies in the past few years, it is possible to compare corporate strategies and stages of product development of these small companies. Dr. Nanette Newell, founder and Principal of The Synertech Group – a venture capital group in North Carolina, analyzed the technological competence, value added products, and vertical integration schemes of these companies.

Funded Corporate Relationships

	Company	Total
AGS	DuPont, Hilleshog, Kartshamns	3
Calgene	Procter & Gamble, Campbell Soup, Philip Morris, Rhone Poulenc, Kemira Oy, Roussel Uclaf, Ciba Geigy, one other	8
DNAP	Campbell Soup, General Foods, Hershey Foods, American Home Products, Farms of Texas, Koppers, CPC International, Du Pont, Brown & Williamson, Firmenich	10
Escagen	American Maize Products, Anheuser Busch, Del Monte, Harris Moran, Lafarge Coppee, Sime Darby, two others	8
NPI	McCormick	1
PGI	McCormick, Kirin	2

Souce: The Synertech Group, Inc.

Many major U.S. companies have funded corporate relationships with agricultural biotechnology speciality companies.

She presented the finding at the AgBIOTECH conference.

Newell said that the successful companies will not only have expertise in the key technologies of breeding; tissue and cell culture; and molecular biology and biochemistry, but will also diversify into several crops. Her results are shown in the chart.

Public opinion critical

While federal regulations governing biotechnology will have a major impact on the timing, direction, and impact of this technology, the American public's opinions and perceptions will be an important component in the federal government's role of managing the technology. These attitudes were explored in a nationwide survey conducted by Louis Harris & Associates for the Congressional Office of Technology (OTA).

Dr. Robyn Y. Nishimi, Analyst and Study Director, OTA, reported that support for continued biotechnological research appears in all segments of the population.

"The public perceives that the benefits of biotechnology, including agricultural applications, are sufficient to justify the risks—but that strict regulation is necessary," he added.

	Technology	Crop Diversity	Value Added Products	Corporate Relationships	Vertical Integration	Revenues from Biotech Products	Market Value ($MM, 11/23/87)
AGS*	+ +	+ + +	-	+	-	+	45
Calgene	+ +	+ + +	+	+ +	+	-	40
DNAP*	+	+ +	+ +	+ +	-	-	53
Escagen	+ + +	+ + +	+ +	+ +	+	-	17
NPI	+ + +	+ +	+	+	+ +	+ + +	NA
PGI	+ +	+	-	+	+	+	24

* On December 17, 1987, it was announced that DNA Plant Technology Corporation and Advanced Genetics Sciences, Inc. had approved an agreement in principle for the two companies to merge.

Source: The Synertech Group, Inc.

The Synertech Group analysed corporate strategies of a number of companies involved in agricultural biotechnology. The results are shown above with rating going from (-) = No significant activity to (+ + +) = Key area of activity for the company.

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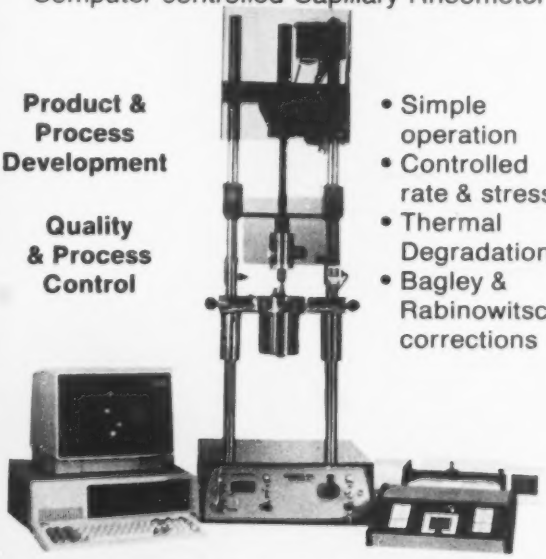

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Circle 48 on Inquiry Card

EQUIPMENT BUYERS' SURVEY

Our Executive Advisory Panel gives its measures, thoughts, and ideas on budgets, equipment purchases, and production projections for the year ahead.

This year's Equipment Buyers' Survey drew 319 responses from members representing a wide range of disciplines.

Black Monday on Wall Street may have left the money men shaken, but the inherent stability of the food industry, combined with ever-improving productivity, and the continuing low raw materials prices is leaving enthusiasm undiminished.

An indication of this is that once again this year, the *Food Engineering* Executive Advisory Panel reports a feeling of optimism about the outlook for their companies. Consider for a moment just one number: 65.8% of the panel projected production increases in their facilities for 1988. As one surveyee noted, 1988 "should be our best year for the introduction of new products and a new line!" Another was a bit more terse but no less pumped up: "Looks good to me!"

Company projections

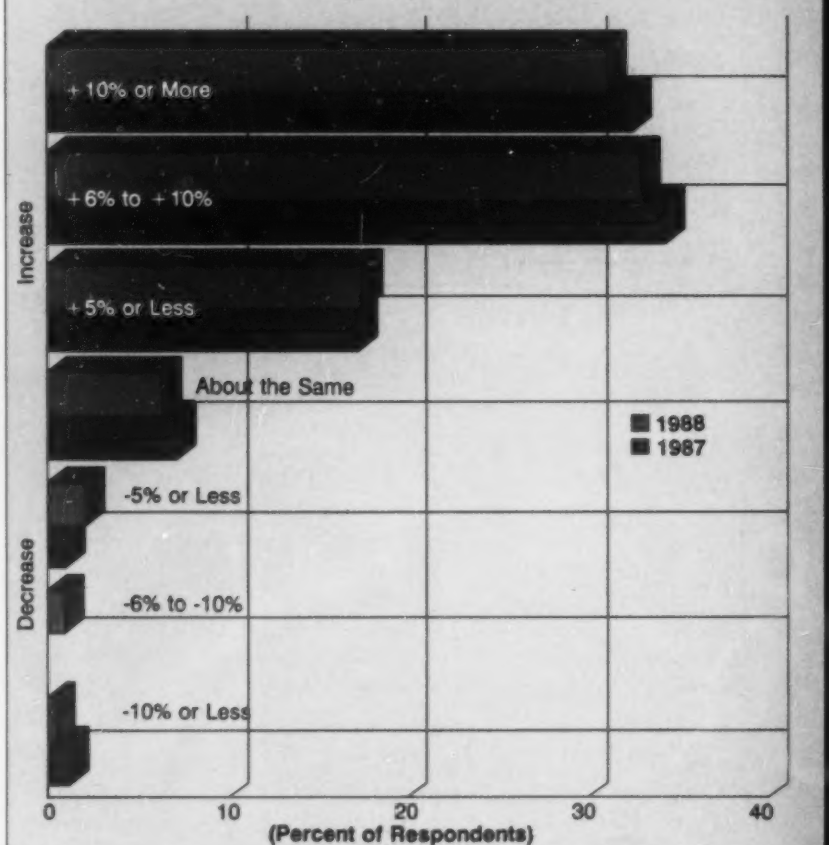
As might be expected, the largest numbers (at least on a percentage basis) came from the smaller companies where opportunities for expansion are greater when compared to the bigger players. Almost 31 percent of the respondents at companies with less than 100 employees feel their plants are looking at 1988 production increases of over 10%. Medium-size companies (100-500 employees) were not, however, far behind, with 27.8 percent expecting a 10+ percent production pickup. Even at large companies (over 500 workers) a respectable 16.3 percent felt things would go the same way for 1988.

Company expenditures

A lot of ink has been spilled about mergers, consolidations, and the big getting bigger and pushing smaller companies out of markets. In light of these facts, a meaningful pattern emerged when we asked respondents what their capital equipment budgets were going to be company-wide in 1988.

MARGIE J. RUSSELL
Senior Associate Editor

Production Increase/Decrease (1987-1988)
(Numbers Reflect Panel Estimates)



Source: Food Engineering Executive Advisory Panel

Budgeting, 1988, By Segment

Dollar figures reflect company wide equipment budgets for fiscal 1988

	Under 50K	50-99K	100-249K	250-499K	500-999K	1M-1.9M	2-4.9M	5+M
Meat	6.7	9.0	10.1	9.0	4.5	10.1	14.6	21.3
Bakery	15.1	5.5	8.2	9.6	2.7	5.5	12.3	28.8
Dairy	9.6	8.5	7.4	7.4	4.3	5.3	13.8	29.8
Flavors/ Ingredients	15.7	6.0	13.3	6.0	7.2	2.4	14.5	22.9
Canned Fruit/ Vegetables	3.5	1.8	8.8	7.0	8.8	7.0	14.0	36.8
Fats/Oils	13.2	3.8	13.2	9.4	5.7	3.8	15.1	20.8
Frozen Fruit/ Vegetables	14.6	7.3	9.8	9.8	0.0	12.2	17.1	17.1
Confectionery Products	11.8	2.0	5.9	5.9	7.8	5.9	11.8	33.3
Cereals/ Grain Products	8.8	5.9	7.4	4.4	2.9	8.8	19.1	30.9
Beverages	11.1	8.3	9.7	8.3	5.6	5.6	6.9	33.3
Other	6.8	10.2	12.5	8.0	4.5	9.1	11.4	30.7

Percentages may not add up to 100% because of multiple responses or partial responses
Source: Food Engineering Executive Advisory Panel

For one thing, the big are not abating spending in any way. Of those companies projecting a $5+MM capital expenses budget, 50 percent were companies with over 500 employees. Less than half that percentage (23.3) of the midsize companies were going to spend an equivalent amount, and barely 5% of small companies would be. Couple this with the fact that 47.7 percent of the large companies and 46.6 percent of midsize companies indicated that expansion and retrofit of existing lines was a major force driving capital expenditures in 1988, and you begin to get a picture of why the small processor, unless well-niched, will continue to have trouble keeping up. In fact, over 60 percent of the small companies will be holding their new purchases to under a quarter of a million dollars.

Last but not least, it should also be noted that the percentage of small companies indicating that they would spend $5+MM dropped by almost half in this year's survey: In 1987 it was 10.1 percent, while this year it is only 5.1 percent. (It is interesting, however, as pointed out above, that even in the face of heavy competition, a large chunk of the small-plant segment is still predicting healthy production gains.)

In general, more than 46 percent of the

Production Projections, 1988 By Segment

Projections are for company-wide production increases/decreases compared to 1987.

	DECREASE			NO CHANGE	INCREASE		
	10+%	6-10%	Under 5%	0	Under 5%	6-10%	10+%
Meat	0.0	1.1	3.4	4.5	15.7	31.5	33.7
Bakery	1.4	1.4	2.7	5.5	20.5	27.4	35.6
Dairy	0.0	1.1	4.3	3.2	20.2	29.8	34.0
Flavors/ Ingredients	0.0	0.0	2.4	4.8	18.1	31.3	33.7
Canned Fruit/ Vegetables	0.0	0.0	1.8	10.5	21.1	38.6	17.5
Fats/Oils	0.0	0.0	0.0	3.8	17.0	37.7	28.3
Frozen fruit/ Vegetables	0.0	0.0	4.9	9.8	14.6	34.1	24.4
Confectionery Products	0.0	0.0	2.0	5.9	29.4	29.4	21.6
Cereals/ Grain Products	0.0	0.0	2.9	4.4	13.2	44.1	27.9
Beverages	0.0	0.0	2.8	12.5	26.4	31.9	22.2
Other	0.0	1.1	1.1	3.4	14.8	33.0	39.8

Percentages may not add up to 100% because of multiple responses or partial responses
Source: Food Engineering Executive Advisory Panel

companies surveyed will be in the "million dollar club," projecting expenditures of $1M and up. And almost 25 percent of the companies fall in the $5M+ range.

Purchasing factors

As we reported in our November issue on new construction, retrofit and expansion of existing lines, while difficult to do without disrupting production, are the preferred methods for increasing a plant's manufacturing capabilities. For example, when asked what factors would drive the purchase of equipment for their companies in 1988, only 27.6 percent of the respondents said that new construction would be a major factor (on the low end was confectionery, which came in at about 17.6 percent; at the high end was cereals/grain products at close to 30 percent).

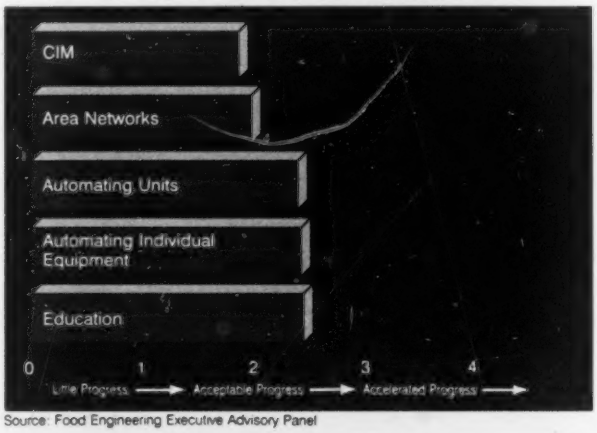
On the other hand, 48.3 percent of the respondents felt that retrofit/expansion of existing lines was a major factor (high was cereals/grain products at 67.6 percent and low was confectionery at 39.2 percent). This includes improving line speeds (42 percent thought it would be a major factor in their 1988 equipment decisions); better process control (39.5 percent), particularly in bakery and cereal products (both at 50 percent); improved on-line QC (31.7 percent), particularly again in bakery (45.2 percent) and cereal (47.1 percent); need for more flexible manufacturing (29.8 percent); need to control excessive downtime (29.8 percent) and improved cleanability (19.4 percent).

Process control

While a lot of companies felt that improved process control would be a key factor in equipment decisions, we wanted to see what the nitty gritty of the present situation really was. The panel was asked to rate their location's progress in several different process control activities: Automating individual equipment, automating processing units and creating distributed control systems, developing full-bore CIM information systems, and educating personnel in process control. Not surprisingly, because the industry is still in the first stages of transition from automation to post-automation computer control, the largest single category of answer was, "Some progress but not much" (depending on the activity, anywhere from 20-37 percent responded this way).

Asked about accelerated progress in these activities, the largest response was pretty small: 6.6 percent of the companies felt they were making accelerated progress in automating processing units.

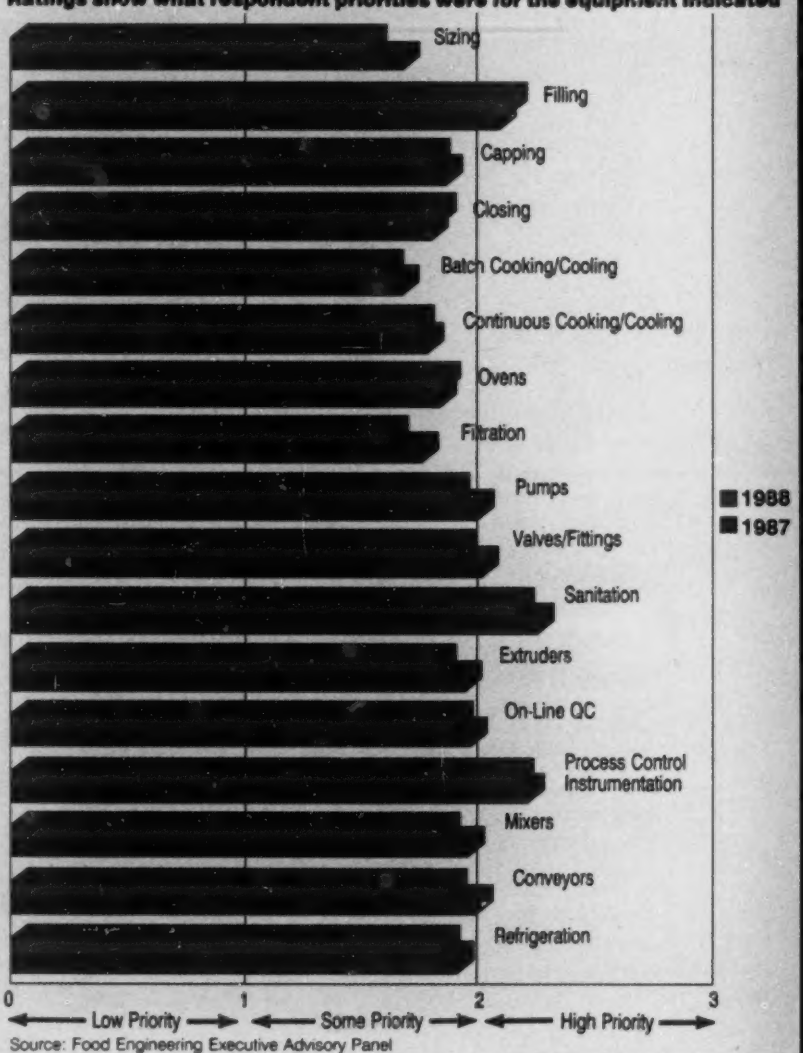
Progress in Process Control Respondents were asked how far along their plants were in different stages of process control



Source: Food Engineering Executive Advisory Panel

Purchase Priority (1987 - 88)

Ratings show what respondent priorities were for the equipment indicated



Source: Food Engineering Executive Advisory Panel

Why such tentative movement? The answers came back loud and clear: Almost half the panel noted cost as a major reason their location was not where they felt it should be in process control. The other, and even more difficult problem, listed by 46.7 percent of the respondents, was NO COMPANY PLAN!

In addition, the panel was asked to rate the important issues in introducing a new piece of process control equipment into their production operations. Some of the things the panel was asked to consider were ease of use, ease of training, user-friendliness of the equipment, report generation capability, ease of programmability, flexibility, and supplier backup. The issues were rated on a scale of 0-3, where 0-1 indicated an unimportant issue for the panel member; 1-2, important but not critical; and 2-3, a critical issue.

The issue the panel rated on top was supplier backup, with a mean score of 2.75. Flexibility was the second most critical matter (2.65), and ease of use was third (2.63). Fortunately for the industry, these were precisely the issues that suppliers of process control equipment were addressing at last year's IEFP and Dairy Expo shows. So at least the help is out there if planning and dollars can be organized to get the job done.

Installation time

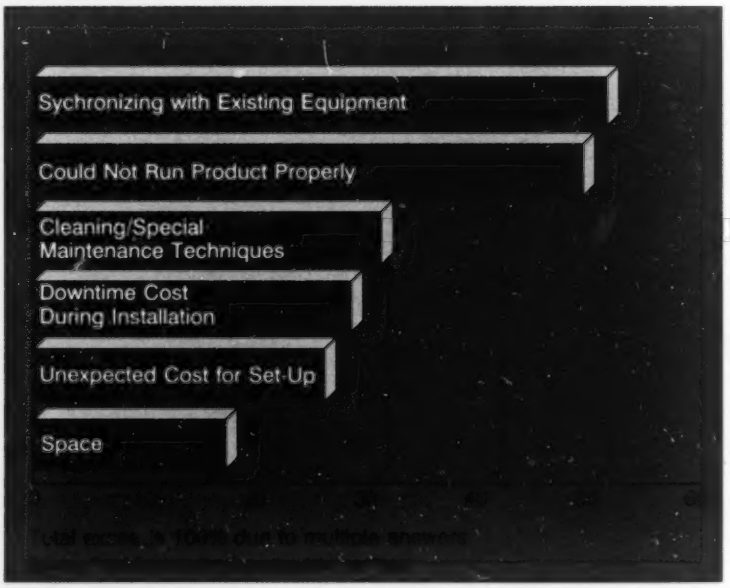
Getting a piece of equipment or a control system up and running is one of the great challenges for plant engineering and QC. Space/location problems, whether the equipment as delivered can run the product properly, special maintenance requirements, and unexpected downtime can all make installation an illustration of that old principle that whatever could go wrong will go wrong. So first we wanted to know how long it took to get new equipment up and running. Most plants (48.4 percent) get things humming (or at least adequately stumbling along) in less than three months, and 32.2 percent in less than one month. The variances often come from the size of the company, larger companies generally getting it done slower, and smaller companies faster.

Some of the faster times were turned in by the meat segment (36 percent of the respondents reporting it took them less than a month to get equipment in), frozen fruit and vegetable (31.7 percent), and beverage (30.6). There were a few cereal and bakery products respondents, however, who were taking a year or more to get equipment in, but these were clearly the exception, even in those segments.

According to our panel, by far the two most serious problems encountered in getting new equipment up and running were synchronizing the new equipment and being able to run the product to spec. Most hangups seemed to be in the confectionery area, with 54.9 percent of the confectionery respondents saying that these were serious problems for them. Not far behind were fats and oils producers (54.7) and bakery (51.4).

Problems In Getting Equipment Up and Running

Where characteristically had respondents experienced problems?



(total exceeds 100% due to multiple answers)

Panel ideas

Last but certainly not least, we let the panel speak its mind on ideas for machinery that they needed but that is not available from any supplier. Not surprisingly, many manufacturers are looking for new equipment that can be matched to new products.

Interestingly, many respondents said that a lot of the equipment they are looking for is rather simple machinery that would solve rather simple production problems. For example, one panelist wanted "a machine to pack sausage in a box." On the other hand, two respondents wanted "high-speed fillers (150-300 units/minute) for plastic containers," and "a data collection computer that also can do process control." Another wanted, "an on-line salt analyzer." Sometimes technology is not the answer, as we were reminded by the panelist who asked for "employees that show up on time!" This last one may prove to be the most complex request, and the trouble is that it will never be available from any supplier.